Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1 – 60. (canceled).

61. (new) A wavelength-tunable light generator that is used in an optical coherence tomography device that measures the structure in the depth direction of a measurement object by irradiating said measurement object with light and detecting the reflected light or backscattered light produced within the measurement object, wherein said wavelength-tunable light generator is capable of changing the wave number of said light stepwise.

62. (new) The wavelength-tunable light generator according to claim 61 in which the width of the tunable range of said wave number is at least $4.7\times10^{-2}\ \mu m^{-1}$ and the frequency width of the emitted light is no more than 13 GHz, comprising:

means capable of changing the wave number stepwise at wave number intervals of no more than $3.1\times10^{-4}\ \mu m^{-1}$ and time intervals of no more than 530 μs.

63. (new) The wavelength-tunable light generator according to claim 61 in which the width of the tunable range of said wave number is at least $4.7\times10^{-2}\ \mu m^{-1}$ and the frequency width of the emitted light is no more than 52 GHz, comprising:

means capable of changing the wave number stepwise at wave number intervals of no more than $12.4\times10^{-4}\ \mu m^{-1}$ and time intervals of no more than 530 μs.

64. A wavelength-tunable light generator that is used as a wavelength-tunable light source of an optical coherence tomography device comprising a wavelength-tunable light source, means for dividing the output light of said wavelength-tunable

light source into a first light beam and a second light beam, means for irradiating a measurement object with the first light beam, means for combining the first light beam that has been reflected or backscattered by said measurement object and the second light beam, means for measuring intensities of output light combined by said means for combining for each of wave numbers of said wavelength-tunable light source, and means for specifying, in the depth direction of said measurement object, the position at which the first light beam is reflected or backscattered by said measurement object from a set of said intensities of output light obtained for each of said wave numbers by means of said means for measuring,

wherein the width of the tunable range of the wave number is increased so that the resolution is no more than 80 μm and the frequency width and wave number interval of the emitted light are reduced so that the measurable range is at least 10 mm, said wavelength-tunable light generator further comprising:

means capable of changing the wave number stepwise at time intervals of no more than the time obtained by dividing the first value obtained by dividing said resolution by the speed 1 mm/s by the second value obtained by dividing the width of said tunable range by said wave number interval.

65. A wavelength-tunable light generator that is used as a wavelength-tunable light source of an optical coherence tomography device comprising a wavelength-tunable light source, means for dividing the output light of said wavelength-tunable light source into a first light beam and a second light beam, means for irradiating a measurement object with the first light beam, means for combining the first light beam that has been reflected or backscattered by said measurement object, and the second light beam, means for measuring intensities of output light combined by said means for combining for each of wave numbers of said wavelength-tunable light source, and means for specifying, in the depth direction of said measurement object, the position and intensity with which the first light beam is reflected or backscattered by said measurement object from a set of said intensities of output light obtained for each of the wave numbers by means of said means for measuring,

wherein the width of the tunable range of the wave number is increased so that the resolution is no more than 80 μm and the frequency interval and wave number interval of the emitted light are reduced so that the measurable range is at least 10 mm, the wavelength-tunable light generator further comprising:

means capable of changing the wave number stepwise at time intervals of no more than the time obtained by dividing the first value obtained by dividing said resolution by the speed 1 mm/s by the second value obtained by dividing the width of said tunable range by said wave number interval.

66. A wavelength-tunable light generator that is used as a wavelength-tunable light source of an optical coherence tomography device comprising a wavelength-tunable light source, means for dividing the output light of said wavelength-tunable light source into a first light beam and a second light beam, means for irradiating a measurement object with the first light beam, means for combining the first light beam that has been reflected or backscattered by said measurement object, and the second light beam, means for measuring intensities of the output light combined by said means for combining for each of wave numbers of said wavelength-tunable light source, and means for specifying, in the depth direction of said measurement object, the position and intensity with which the first light beam is reflected or backscattered by said measurement object from a set of intensities of said output light obtained for each of the wave numbers by means of said means for measuring,

wherein the width of the tunable range of the wave number is increased so that the resolution is no more than 80 μm and the frequency width and wave number interval of the emitted light are reduced so that the measurable range is at least 2.5 mm, the wavelength-tunable light generator further comprising:

means capable of changing the wave number stepwise at time intervals of no more than the time obtained by dividing the first value obtained by dividing said resolution by the speed 4 mm/s by the second value obtained by dividing the width of said tunable range by the wave number interval.

67. The wavelength-tunable light generator according to claim 65, wherein said means for irradiating a measurement object with the first light beam are capable of scanning an irradiation position at which said measurement object is irradiated with the first light beam, said wavelength-tunable light generator further comprising:

means for constructing a tomogram of said measurement object on the basis of information specified by said means for specifying and information relating to said irradiation position.

68. The wavelength-tunable light generator according to claim 65, wherein said means for specifying subject a combination of real numbers comprising said intensities of said output light and said wave numbers to a Fourier transform.

69. The wavelength-tunable light generator according to claim 61, further comprising:

means for constructing a motion image of a tomogram of said measurement object by constructing a plurality of said tomogram.

70. The wavelength-tunable light generator according to claim 61, wherein a light-emitting element constituting the wavelength-tunable light generator is a wavelength-tunable laser.

71. The wavelength-tunable light generator according to claim 61, wherein a light-emitting element constituting the wavelength-tunable light generator is a super structure grating distributed Bragg reflector semiconductor laser.

72. The wavelength-tunable light generator according to claim 61, wherein a light-emitting element constituting the wavelength-tunable light generator is a sampled grating distributed Bragg reflector semiconductor laser.

73. An optical coherence tomography device, wherein the wavelength-tunable light generator according to claim 61 is used as a light source.

74. An optical coherence tomography device comprising the wavelength-tunable light generator according to claim 61, and further comprising:

means for dividing the output light of said wavelength-tunable light generator into a first light beam and a second light beam;

means for irradiating a measurement object with the first light beam;

means for combining said first light beam that has been reflected or backscattered by said measurement object, and the second light beam;

means for measuring intensities of output light combined by said means for combining for each of wave numbers of said wavelength-tunable light generator; and

means for specifying, in the depth direction of said measurement object, the position at which the first light beam is reflected or backscattered by said measurement object from a set of said intensities of output light obtained for each of said wave numbers by means of said means for measuring.

75. An optical coherence tomography device comprising the wavelength-tunable light generator according to claim 61, and further comprising:

means for dividing the output light of said wavelength-tunable light generator into a first light beam and a second light beam;

means for irradiating a measurement object with the first light beam;

means for combining said first light beam that has been reflected or backscattered by said measurement object, and the second light beam;

means for measuring intensities of output light combined by said means for combining for each of wave numbers of said wavelength-tunable light generator; and

means for specifying, in the depth direction of said measurement object, the position and intensity with which the first light beam is reflected or backscattered by

said measurement object from a set of said intensities of output light obtained for each of said wave numbers by means of said means for measuring.

76. The optical coherence tomography device according to claim 74, wherein said means for irradiating a measurement object with the first light beam are capable of scanning an irradiation position of the first light beam, the optical coherence tomography device further comprising:

means for constructing a tomogram of said measurement object on the basis of information specified by said means for specifying and information relating to said irradiation position.

77. The optical coherence tomography device according to claim 74, wherein said means for specifying subject a combination of real numbers comprising the intensity of said output light and said wave numbers to a Fourier transform.

78. The optical coherence tomography device according to claim 74, further comprising:

means for constructing a motion image of a tomogram of said measurement object by constructing a plurality of said tomogram.

79. An optical coherence tomography device comprising the wavelength-tunable light generator according to claim 61, and further comprising:

a sample optical path that guides output light of said wavelength-tunable light generator to a sample without dividing the output light;

a partial reflection mechanism that returns a portion of the irradiated light of said sample optical path along said sample optical path; and

an optical detection optical path that guides the reflected light and backscattered light from the sample along said sample optical path and the reflected light from the partial reflection mechanism to a photodetector.

80. An optical coherence tomography device comprising the wavelength-tunable light generator according to claim 61, and further comprising:

a sample optical path that guides output light of said wavelength-tunable light generator to a sample without dividing the output light;

a partial reflection mechanism that reflects a portion of the light of said sample optical path along said sample optical path after affording the portion of light with a desired polarization characteristic;

a sample light polarization-specifying mechanism that irradiates the sample with light that has been transmitted by the partial reflection mechanism in said sample optical path after affording the transmitted light the desired polarization characteristic; and

an optical detection optical path that guides the reflected light and backscattered light from the sample and the reflected light from the partial reflection mechanism to means for dividing incident light into two components of the polarization directions which are orthogonal,

wherein two outputs of said means for dividing incident light into two components of the polarization directions which are orthogonal are detected by using a photodetector and an amplifier respectively, output data of said amplifier are sent to a data processor, and a tomogram showing the polarization characteristic of the sample is constructed by the data processing of said data processor.

81. A wavelength-tunable light generator for dental optical coherence tomography, wherein the wavelength can be switched stepwise in the range 0.9 μm to 5.0 μm.

82. The wavelength-tunable light generator for dental optical coherence tomography according to claim 81, wherein the width of the tunable range of said wave number is at least 4.7×10^{-2} μm^{-1}, the frequency width of the emitted light is no more than 13 GHz, the wave number interval is no more than 3.1×10^{-4} μm^{-1}, and said wave number can be switched stepwise at time intervals of no more than 530 μs.

83. A dental optical coherence tomography device which uses the wavelength-tunable light generator according to claim 21 in a light source as wavelength-tunable light generating means.

84. The dental optical coherence tomography device according to claim 83, comprising:

polarization characteristic measuring means for measuring the polarization characteristic of a tooth.

85. The dental optical coherence tomography device according to claim 84, wherein said polarization characteristic measuring means comprise:

main dividing means for dividing the light from said wavelength-tunable light generating means into measurement light and reference light with controlling the polarization direction of the light;

measurement light irradiating means for irradiating a tooth in an oral cavity with said measurement light divided by said main dividing means;

signal light collecting means for collecting signal light that is reflected by the tooth following irradiation of said tooth;

combining means for separating said signal light collected by said signal light collecting means into components of two or more polarization directions and for respectively combining the separated light components with said reference light divided by said main dividing means; and

computation control means for finding the polarization characteristic of said tooth on the basis of the intensity of the signal light of different polarization directions thus combined.

86. The dental optical coherence tomography device according to claim 83, wherein said polarization characteristic measuring means comprise:

main dividing means for dividing the light from said wavelength-tunable light generating means into measurement light and reference light;

measurement light irradiating means for irradiating a tooth in an oral cavity with said measurement light divided by said main dividing means;

signal light collecting means for collecting said signal light that is reflected by the tooth following the irradiation of said tooth;

combining means for combining the signal light collected by said signal light collecting means and said reference light divided by said main dividing means; and

computation control means for controlling said wavelength-tunable light generating means so that said light from said wavelength-tunable light generating means has the intended wavelength range and for finding the characteristics of said tooth on the basis of the wavelength range of the light from said wavelength-tunable light generating means and the intensity of the light combined by said combining means,

wherein said computation control means control said wavelength-tunable light generating means so that light of a plurality of different wavelength ranges is output and find the characteristics of said tooth by finding the intensity of said light combined by said combining means for each wavelength range.

87. A dental optical coherence tomography device, comprising:

wavelength-tunable light generating means;

main dividing means for dividing the light from said wavelength-tunable light generating means into measurement light and reference light;

measurement light irradiating means for irradiating a tooth in an oral cavity with said measurement light divided by said main dividing means;

signal light collecting means for collecting the signal light that is reflected by the tooth following the irradiation of said tooth;

combining means for combining the signal light collected by said signal light collecting means and said reference light divided by said main dividing means; and

computation control means for controlling said wavelength-tunable light generating means so that said light from said wavelength-tunable light generating means has the intended wavelength range and for finding the characteristics of said tooth on the basis of the wavelength range of the light from said wavelength-tunable light generating means and the intensity of the light combined by said combining means,

wherein said computation control means control said wavelength-tunable light generating means so that light of a plurality of different wavelength ranges is output and find the characteristics of said tooth by finding the intensity of the light combined by said combining means for each wavelength range.

88. The dental optical coherence tomography device according to claim 86, wherein said computation control means find the light absorption coefficient of said tooth by finding the intensity of the light combined by said combining means for each wavelength range and find the characteristics of said tooth on the basis of said light absorption coefficient.

89. The dental optical coherence tomography device according to claim 88, wherein said computation control means find the abundance per unit volume of the composition of the enamel or dentine of said tooth on the basis of said light absorption coefficient.

90. The dental optical coherence tomography device according to claim 89, wherein said computation control means further find the water concentration per unit volume of the enamel or dentine of said tooth on the basis of said light absorption coefficient.

91. The dental optical coherence tomography device according to claims 83, wherein said wavelength-tunable light generating means are a wavelength-tunable semiconductor laser light generator.

92. A dental optical coherence tomography device, comprising:

wavelength-tunable light generating means;

main dividing means for dividing the light from said wavelength-tunable light generating means into measurement light and reference light;

measurement light irradiating means for irradiating a tooth in an oral cavity with said measurement light divided by said main dividing means;

signal light collecting means for collecting the signal light that is reflected by the tooth following the irradiation of said tooth;

combining means for combining the signal light collected by said signal light collecting means and said reference light divided by said main dividing means; and

computation control means for controlling said wavelength-tunable light generating means so that said light from said wavelength-tunable light generating means has the intended wavelength range and for finding the characteristics of said tooth on the basis of the wavelength range of said light from said wavelength-tunable light generating means and the intensity of said light combined by said combining means,

wherein the wavelength-tunable light generating means are a wavelength-tunable semiconductor laser light generator .

93. The dental optical coherence tomography device according to claim 87, wherein said wavelength-tunable light generating means output light in a wavelength range between 1.2 μm and 5.0 μm.

94. The dental optical coherence tomography device according to claim 93, wherein said wavelength-tunable light generating means output light in a wavelength range wider than 1.3 μm to 1.6 μm within 1.2 μm and 5.0 μm.

95. The dental optical coherence tomography device according to claim 93, wherein said main dividing means and said combining means are combined to serve as main dividing and combining means.

96. The dental optical coherence tomography device according to claim 93, wherein said measurement light irradiating means and said signal light collecting means are combined to serve as irradiating and collecting means.

97. The dental optical coherence tomography device according to claim 96, wherein said irradiating and collecting means comprise:

an outer tube that is flexible and optically transparent at least at the leading end;

a flexible inner tube that is laid within said outer tube so as to be capable of rotating in a circumferential direction and is formed with an I/O light window for said measurement light and said signal light at the leading end thereof;

an optical fiber that is laid within said inner tube and that guides said measurement light and said signal light; and

a probe that is provided at the leading end within said inner tube and that comprises connecting means for optically connecting the leading end of said optical fiber and said I/O light window of said inner tube.

98. The dental optical coherence tomography device according to claim 97, wherein said probe comprises an observation mirror used for visual confirmation at the leading end of said outer tube.

99. An optical coherence tomography device which comprises a wavelength-tunable light generator capable of changing the wave number of light stepwise and which measures the structure in the depth direction of a measurement object by irradiating said measurement object with light that is output from said wavelength-

tunable light generator and detecting reflected light or backscattered light that is produced within said measurement object by means of a detector,

wherein said measurement object is biological tissue.

100. A diagnosis method for tissue constituting a human body, comprising the steps of:

irradiating tissue constituting a human body with light from the wavelength-tunable light generator according to claim 1;

detecting reflected light or backscattered light that is produced within said tissue constituting a human body by means of a detector; and

constructing, by means of an optical coherence tomography, the structure of said tissue constituting a human body in the depth direction on the basis of detection data detected by said detector.

101. A wavelength-tunable light generator for optical coherence tomography, comprising:

a light-emitting section that combines and outputs the outputs of a plurality of wavelength-tunable light sources of different wave number sweep ranges; and

a control device that permits a wave number sweep in excess of the wave number sweep range of individual wavelength-tunable light sources by sweeping said wavelength-tunable light sources one at a time.

102. The optical coherence tomography wavelength-tunable light generator according to claim 101, wherein said wavelength-tunable range is at least 0.2 μm^{-1} as a wave number.

103. A wavelength-tunable light generator for optical coherence tomography, comprising:

a light-emitting section that combines and outputs the outputs of a plurality of wavelength-tunable light sources of different sweep wave numbers; and

a control device that permits a wave number sweep so that the wave numbers that can be output by the individual wavelength-tunable light sources supplement one another by sweeping said wavelength-tunable light sources one at a time.

104. The wavelength-tunable light for optical coherence tomography generator according to claims 101, wherein said plurality of wavelength-tunable light sources of different sweep wave numbers are capable of changing the wave number stepwise.

105. The wavelength-tunable light generator for optical coherence tomography according to claim 101, wherein said light-emitting section comprises an optical switch and said outputs are combined and output by said optical switch.

106. The wavelength-tunable light generator for optical coherence tomography according to claim 101, wherein said wavelength-tunable light sources comprises wavelength-tunable semiconductor lasers.

107. An optical coherence tomography device, comprising:

a wavelength-tunable light generator;

means for dividing the output light of said wavelength-tunable light generator into measurement light and reference light;

means for irradiating a measurement object with said measurement light and for collecting signal light produced as a result of said measurement light being reflected or backscattered by said measurement object;

means for combining said signal light and said reference light;

means for measuring the intensity of the output light combined by said combining means for each wave number of said wavelength-tunable light generator; and

means for specifying, in the depth direction of said measurement object, the position at which said measurement light is reflected or backscattered by said

measurement object and the reflection or backscatter intensity, from a set of intensities of said combined output light measured for each of the wave numbers by said measuring means,

wherein said wavelength-tunable light generator is a wavelength-tunable light generator according to claim 101.

108. The optical coherence tomography device according to claim 107, wherein said dividing means and said combining means are the same means.

109. The optical coherence tomography device according to claim 107, comprising, instead of said means for irradiating a measurement object with said measurement light and for collecting signal light produced as a result of said measurement light being reflected or backscattered by said measurement object:

means for irradiating the measurement object with said measurement light; and

means for collecting signal light produced as a result of said measurement light being reflected or backscattered by said measurement object.

110. The optical coherence tomography device according to claim 107, wherein said specifying means subject a combination of real numbers comprising the intensity of said output light and said wave number to a Fourier transform.

111. An optical coherence tomography device that employs the wavelength-tunable light generator according to claim 101.

112. The optical coherence tomography device according to claim 107, wherein said specifying means correct the fluctuations in the intensity with respect to the wave number of the output light of said wavelength-tunable light generator.

113. The optical coherence tomography device according to claim 107, wherein said specifying means correct the intensity of said output light by using a window function.

114. A wavelength-tunable light generator for optical coherence tomography, wherein the outputs of a plurality of wavelength-tunable light sources of a different frequency sweep range or a different sweep wave number are combined and output.

115. The optical coherence tomography device according to claim 107, wherein said specifying means subject a combination of real numbers comprising said intensity of the output light combined by said combining means and said wave number to a Fourier transform.

116. The optical coherence tomography device according to claim 115, wherein said specifying means correct said intensity of the output light combined by said combining means so as to eliminate the effect of fluctuations in the intensity with respect to the wave number of the output light of said wavelength-tunable light generator.

117. The optical coherence tomography device according to claim 116, wherein said correction is performed by multiplying a reciprocal number of a value that is obtained by sequentially measuring the intensity of the output light of said wavelength-tunable light generator each time said wave number is changed during the measurement by said optical coherence tomography device, or a numerical value that is proportional to said reciprocal number, by said intensity of the output light combined by said combining means.

118. The optical coherence tomography device according to claim 116, wherein said correction is performed by multiplying a reciprocal number of a value that is obtained by pre-measuring, for each of said wave numbers, the intensity of

the output light of said wavelength-tunable light generator, or a numerical value that is proportional to said reciprocal number, by the intensity of said combined output light.

119. The optical coherence tomography device according to claim 115, wherein said specifying means use a window function to modify said intensity of the output light combined by said combining means or said intensity of the output light combined by said combining means, which is corrected so as to eliminate the effect of fluctuations in the intensity with respect to the wave number of the output light of said wavelength-tunable light generator.

120. The optical coherence tomography device according to claim 115, wherein said specifying means correct said intensity of the output light combined by said combining means so as to obtain the same measurement result as the measurement result obtained when the intensity distribution with respect to the wave number of the output light of said wavelength-tunable light generator matches a desired window function.